PRELIMINARY DATA SHEET

SKY65168-11: Medium Power 802.11a WLAN Power Amplifier

Applications

- IEEE802.11a WLAN enabled:
  - access points
  - media gateways
  - set top boxes
  - LCD TVs
- Other broadband triple-play multimedia applications

Features

- Linear output power of +22 dBm for IEEE 802.11a 64-QAM, EVM < 3% @ 5.0 V
- High gain of 26.3 dB @ 5.0 V
- Quiescent Current @ 5.0 V = 245 mA
- Output power detector: 20 dB dynamic range
- Power shutdown mode
- Superior gain flatness
- Internal RF match and bias circuits
- Small footprint QFN (16-pin, 3 x 3 mm) SMT package (MSL3, 260 °C per JEDEC J-STD-020)

NEW

Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.

Description

Skyworks SKY65168-11 is a Microwave Monolithic Integrated Circuit (MMIC) Power Amplifier (PA) with superior output power, linearity, and efficiency. These features make the SKY65168-11 ideal for Wireless Local Area Network (WLAN) applications.

The device is fabricated using Skyworks high reliability Indium Gallium Phosphide (InGaP) Heterojunction Bipolar Transistor (HBT) technology. The device is internally matched and mounted in a 16-pin, 3 x 3 mm Quad Flat No-Lead (QFN) Surface-Mounted Technology (SMT) package, which allows for a highly manufacturable low cost solution.

The device package and pinout for the 16-pin QFN are shown in Figure 1. A block diagram of the SKY65168-11 is shown in Figure 2.

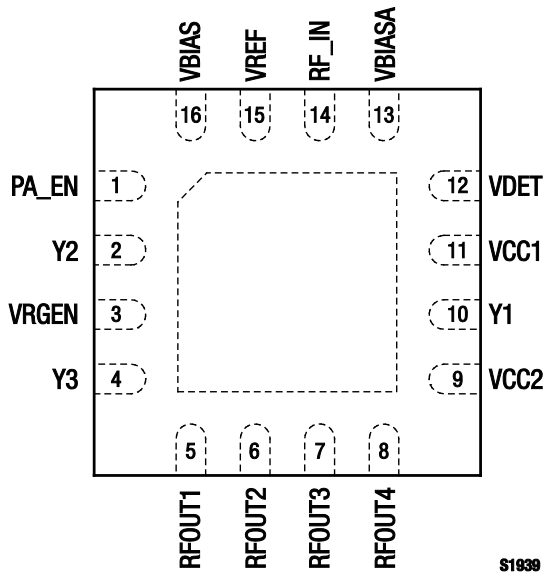


Figure 1. SKY65168-11 Pinout – 16-Pin QFN (Top View)

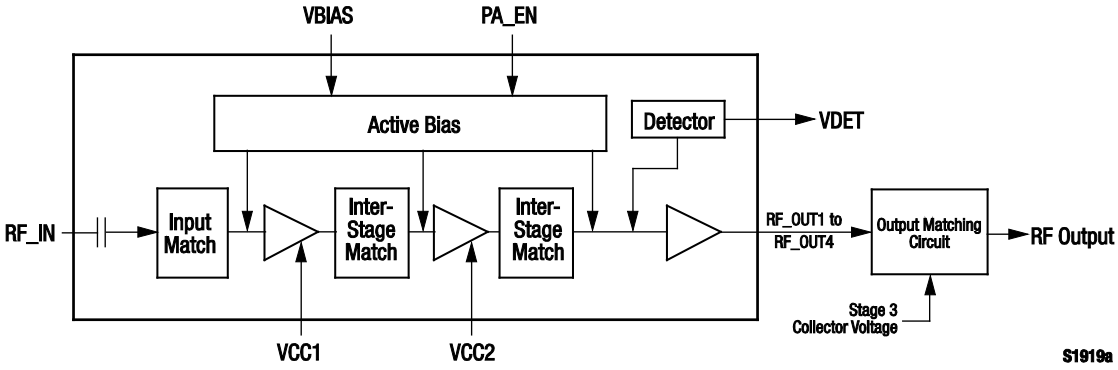


Figure 2. SKY65168-11 Block Diagram

Technical Description

The SKY65168-11 PA contains all of the needed RF matching and DC biasing circuits. The device also provides an output power detector voltage.

The SKY65168-11 is a three-stage, HBT InGaP device optimized for high linearity and power efficiency. These features make the device suitable for wideband digital applications, where PA linearity and power consumption are of critical importance (e.g., WLANs).

The device has been characterized with the highest specified data rates for IEEE802.11a (54 Mbps). Under these stringent test conditions, the device exhibits excellent spectral purity and power efficiency.

Electrical and Mechanical Specifications

Signal pin assignments and functional pin descriptions are described in Table 1. The absolute maximum ratings of the SKY65168-11 are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY65168-11 are illustrated in Figures 3 through 8.

Table 1. SKY65168-11 Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	PA_EN	PA enable (3 to 5 V)	9	VCC2	Stage 2 collector voltage (5 V)
2	Y2	Second stage bias decoupling capacitor	10	Y1	First stage bias decoupling capacitor
3	VRGEN	Reference voltage generator	11	VCC1	Stage 1 collector voltage (5 V)
4	Y3	Third stage bias decoupling capacitor	12	VDET	Detector voltage output
5	RF_OUT1	RF output pin 1	13	VBIASA	Bias voltage decoupling capacitor
6	RF_OUT2	RF output pin 2	14	RF_IN	RF input pin
7	RF_OUT3	RF output pin 3	15	VREF	Reference voltage
8	RF_OUT4	RF output pin 4	16	VBIAS	Bias voltage

Table 2. SKY65168-11 Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Minimum	Maximum	Units
RF output power	P_{OUT}		+27	dBm
Supply voltage	VCC1, VCC2, VBIAS	4.5	5.5	V
PA enable	PA_EN		5	V
Total supply current	I_{CC}		400	mA
Power dissipation	P_D		***** TBD *****	W
Thermal resistance	Θ_{JC}		***** TBD *****	°C/W
Case temperature	T_C	–40	+85	°C
Storage temperature	T_{ST}	–55	+125	°C
Junction temperature	T_J		+150	°C

Note 1: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

***CAUTION**: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.*

Table 3. SKY65168-11 Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating frequency	f	5000		5900	MHz
RF output power	P_{OUT}		+22		dBm
Supply voltage	VCC1, VCC2, VBIAS	4.75	5.00	5.25	V
PA enable	PA_EN		3	5	V
Total supply current	I_{CC}		285		mA
Case operating temperature	T_C	–40	+25	+85	°C

Table 4. SKY65168-11 Electrical Specifications (Note 1)
(VCC1 = VCC2 = VBIAS = PA_EN = 5 V, T_C = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Using Continuous Wave Input						
Quiescent Current	I_{CQ}			245		mA
1 dB output compression point	OP1dB			+27		dBm
Small signal gain	|S21|			26.3		dB
Gain flatness				±0.5		dB
Input return loss	|S11|			12		dB
Output return loss	|S22|			12		dB
Detector voltage	V_{DET}	P_{OUT} = +22 dBm		0.4		V
Using IEEE802.11a Orthogonal Frequency Division Multiplexing Input Signal, 64 QAM and 54 Mbps						
Operational current	I_{CC}	P_{OUT} = +22 dBm		285		mA
Error Vector Magnitude	EVM	P_{OUT} = +22 dBm		3		%

Note 1: Performance is guaranteed only under the conditions listed in this Table.

Typical Performance Characteristics

(VCC1 = VCC2 = VBIAS = 5 V, PA_EN = 3 V, f = 5750 MHz, T_C = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

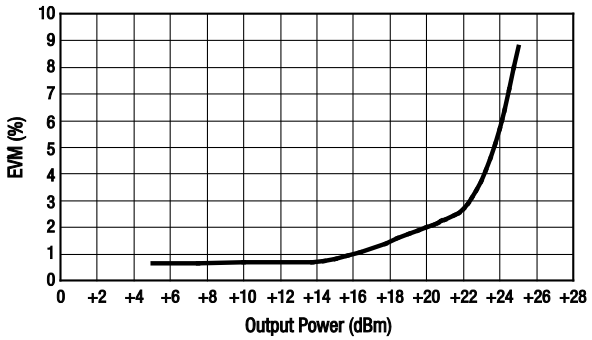


Figure 3. EVM vs Output Power
(802.11a, 64 QAM, 54 Mbps, 60% Duty Cycle)

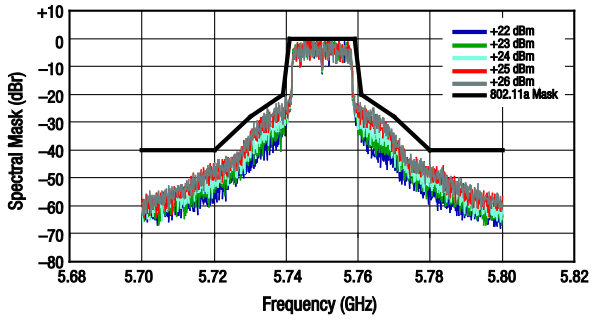


Figure 4. Spectral Mask vs Frequency Over Output Power
(802.11a, 64 QAM, 54 Mbps, 60% Duty Cycle)

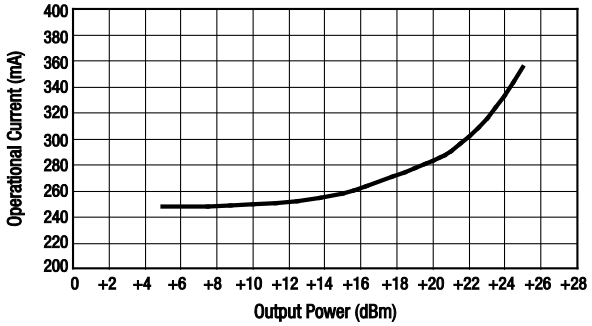


Figure 5. Current vs Output Power
(802.11a, 64 QAM, 54 Mbps, 60% Duty Cycle)

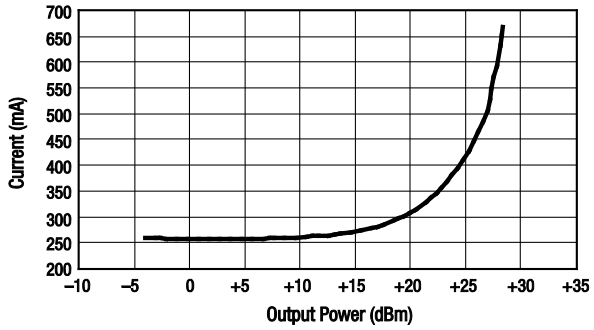


Figure 6. Current vs Output Power
(Continuous Wave)

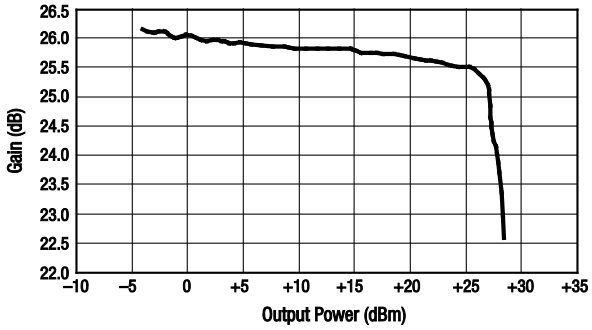


Figure 7. Gain vs Output Power (Continuous Wave)

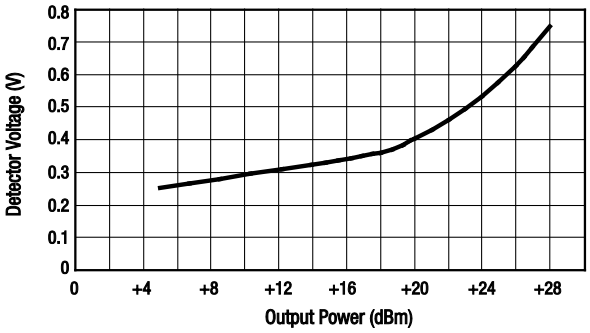


Figure 8. Detector Voltage vs Output Power

Evaluation Board Description

The SKY65168-11 Evaluation Board is used to test the performance of the SKY65168-11 WLAN PA. An assembly drawing for the Evaluation Board is shown in Figure 9 and the layer detail is provided in Figure 10. A schematic diagram of the SKY65168-11 Evaluation Board is shown in Figure 11.

Circuit Design Considerations

The following design considerations are general in nature and must be followed regardless of final use or configuration:

1. Paths to ground should be made as short as possible.
2. The ground pad of the SKY65168-11 has special electrical and thermal grounding requirements. This pad is the main thermal conduit for heat dissipation. Since the circuit board acts as the heat sink, it must shunt as much heat as possible from the device. Therefore, design the connection to the ground pad to dissipate the maximum wattage produced by the circuit board. Multiple vias to the grounding layer are required. For further information, refer to the Skyworks Application Note *PCB Design Guidelines for High Power Dissipation Packages*, document number 201211.
3. Bypass capacitors should be used on the DC supply lines. Refer to the schematic drawing in Figure 11 for further details.
4. The RF lines should be well separated from each other with solid ground in between traces to maximize input-to-output isolation.

NOTE: *A poor connection between the slug and ground increases junction temperature (T_J), which reduces the lifetime of the device.*

Package Dimensions

The PCB layout footprint for the SKY65168-11 is provided in Figure 12. Package dimensions for the 16-pin QFN are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY65168-11 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

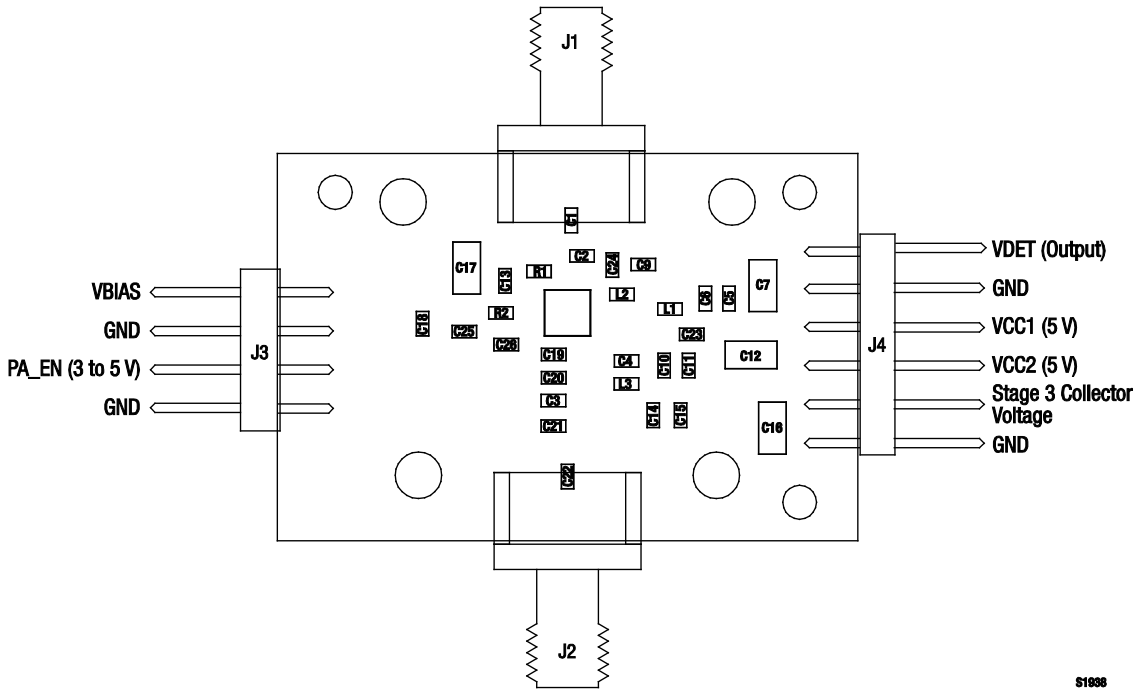


Figure 9. Evaluation Board Assembly Drawing

*** TBD ***

Figure 10. SKY65168-11 Evaluation Board Layer Detail

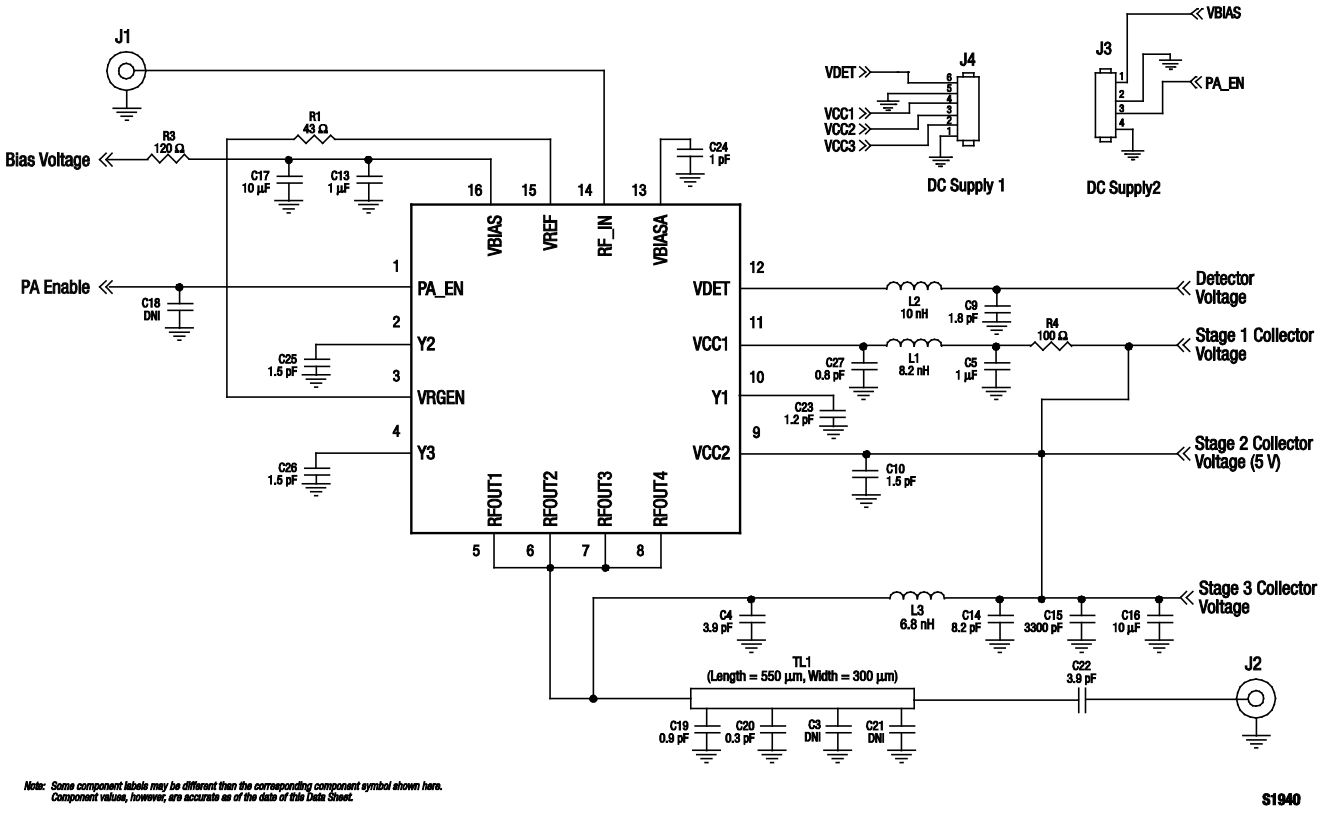


Figure 11. SKY65168-11 Evaluation Board Schematic

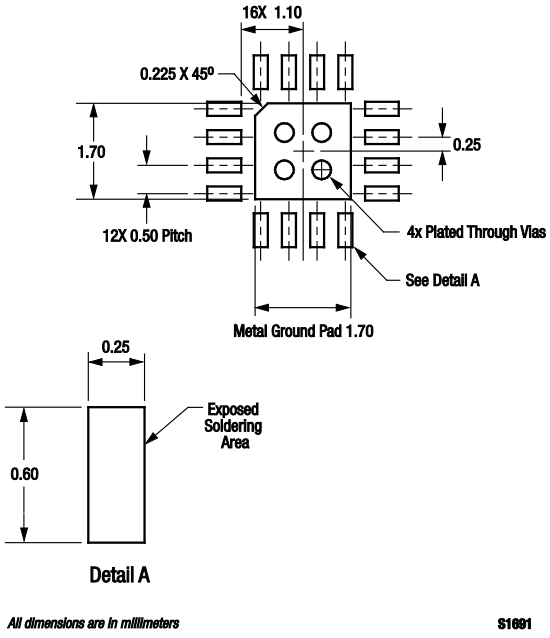
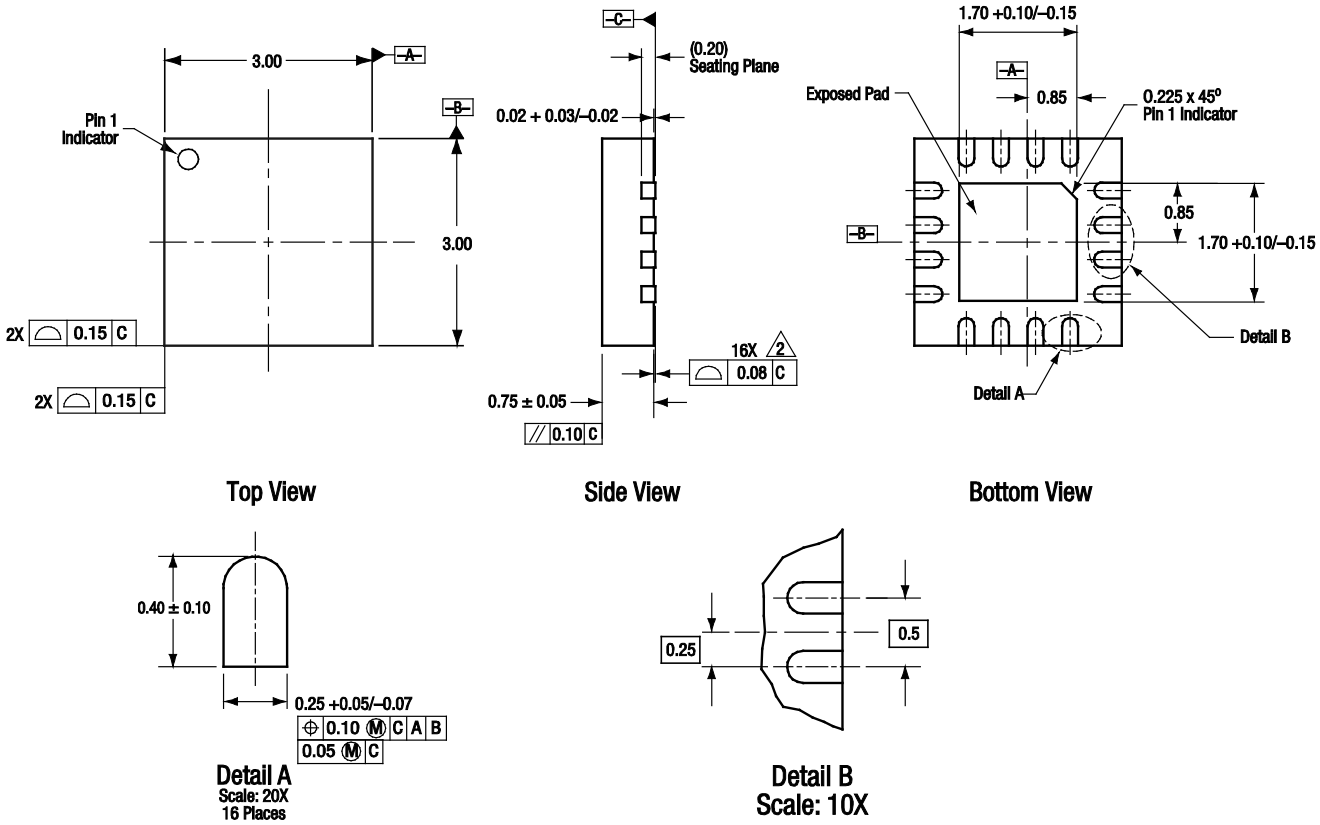


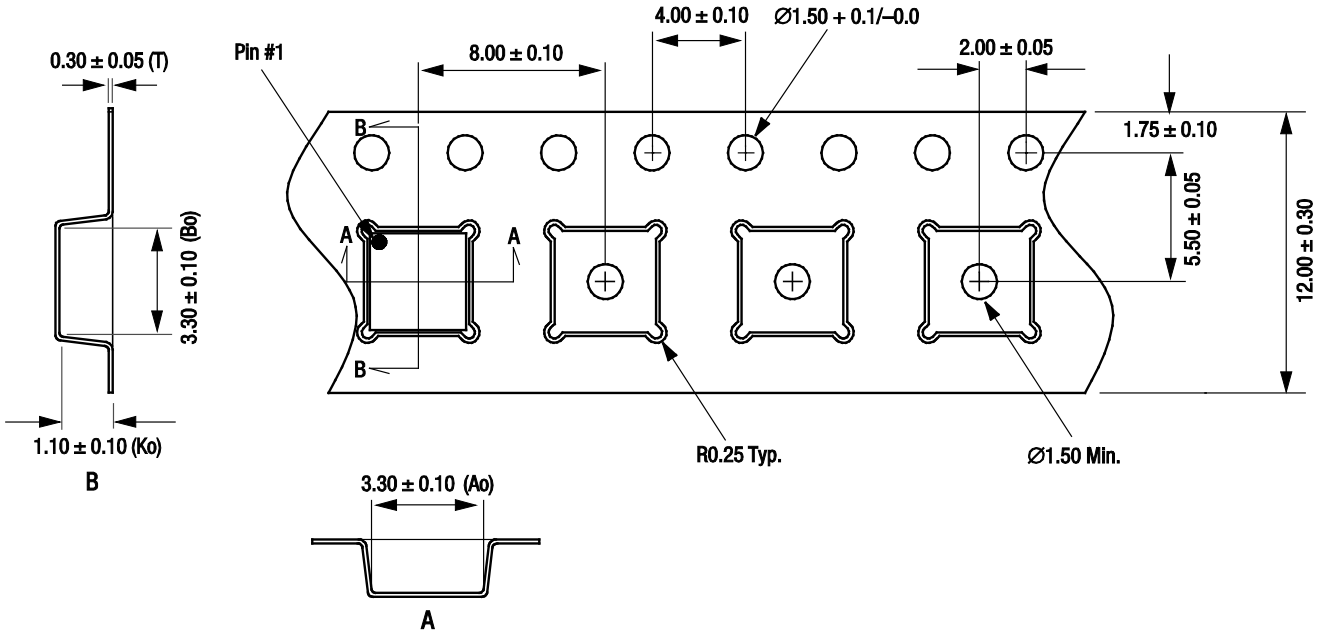
Figure 12. PCB Layout Footprint For The SKY65168-11



All measurements are in millimeters.
Dimensioning and tolerancing according to ASME Y14.5M-1994.
Coplanarity applies to the exposed heat sink slug as well as the terminals..
Plating requirement per source control drawing (SCD) 2504.

S1692

Figure 13. SKY65168-11 16-Pin QFN Package Dimensions



Notes:
1. Carrier tape: black conductive polystyrene, non-bakeable material.
2. Cover tape material: transparent conductive HSA.
3. Cover tape size: 9.20 mm width.
4. All measurements are in millimeters.

S1698

Figure 14. SKY65168-11 16-Pin QFN Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY65168-11 Medium Power WLAN Power Amplifier	SKY65168-11	TW18-D360